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Better Science **Better decisions**

RESEARCH *Highlights*

OCTOBER 2023

How does the ocean's only flowering plant cope with being buried?

In water tanks at Edith Cowan University, pots containing *Posidonia sinuosa*, the most widespread species of seagrass in Cockburn Sound, have been tested to see how much burial under sediment they can withstand. The research, part of the WAMSI Westport Marine Science Program, is looking at the resilience of the ocean's only flowering plant, to dredging.

ECU researcher, Dr Chanelle Webster, said seagrass was an important part of the ecosystem – providing not only food and habitat for marine animals but also stabilising the seabed and storing carbon, which could help combat climate change.

Seagrasses tend to occur in the shallow waters along coastlines as they require a lot of sunlight, but they are easily affected by disturbances in the light reaching the plants.

"One of the main impacts of dredging is changing the amount of light plants receive when sediment is stirred up during operation," Dr Webster said.

"Another effect of dredging on seagrass is when sediment gets moved and dumped in an area, the particles can settle on seagrass and bury it. This is where my experiment comes in."

"There are about 10 different species of seagrass in the Sound but *Posidonia sinuosa* is the main species, you can find it in all areas of the Sound from Kwinana to Garden Island, and this is why we decided to do the experiment with this species."

"We have been trying to understand how much burial *Posidonia sinuosa* can tolerate before you start seeing negative impacts to their growth or survival."

Some of the potted seagrasses had no sediment added, others had up to 16cm of sediment put on them in controlled conditions over four months.

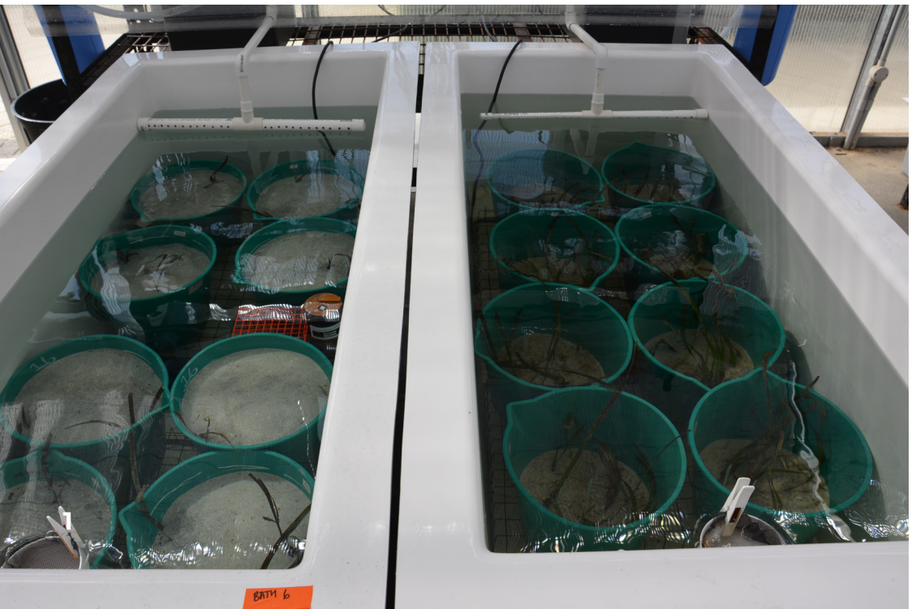
The research team measured the amount the plants grew and noted cellular changes.

"From preliminary analysis, plants tolerate up to 4 cm of burial by sediment but with 8 cm and more of burial they are impacted.

"When plants were buried by 8cm or more of sediment the growth was significantly less."

The research indicated Posidonia sinuosa could tolerate burial of 4cm of sediment for 16 weeks, which was the duration of the experiment.

Dr Webster said while further analysis was still to be done, the preliminary results were promising in terms of being able to minimise impacts to seagrasses in the Sound.



Data team collecting, checking and delving into historical records

While dozens of scientists working at Cockburn Sound are busy with field trips and laboratory work, a team behind the scenes is occupied with managing huge amounts of research data while also uncovering and collating crucial historical data to feed back to the projects.

Dr Alicia Sutton, who is part of the Western Australian Marine Science Institution Location Data Management Services team, said its role was to help with quality control on current data collection and locate historical scientific information to support the WAMSI Westport Marine Science Program's 30 projects.

"With historical data, we collate data from as far back as possible," Dr Sutton said.

"That is going to be really helpful for future projects and will allow researchers and other stakeholders to access relevant data easily, without having to contact multiple organisations and trawl through large volumes of reports," Dr Sutton said.

The range of the data coming in from the projects is broad. It includes spatially mapped data, photos and video footage, models, acoustic spectrograms, social surveys, laboratory and field experimental studies and biological surveys.

"In the case of data collected during the WAMSI Westport Marine Science Program, data will become publicly available and be accessible for the long term."

- Dr Alicia Sutton (WAMSI)

Another example is collating data on beach profiles (measurements of the angles of the shoreline to look at variability in topography and slope) previously collected by local and State Government, which WAMSI researchers are using to understand shoreline movement across time.

"Water quality data has also been collated across industry and government bodies to help inform a water quality response model for Cockburn Sound as part of the WAMSI Westport Marine Science Program."

The data from the current science program, when combined with other available government and industry data, has the potential to support the development of regionally specific products and science outcomes, including hydrodynamic and sediment transport models and integrated marine ecosystem biogeochemistry and ecological models.

Managing the data and keeping it safe is a big task. Data is stored on a collaborative but secure WAMSI storage space as well as at the Pawsey Super Computing Research Centre.

Wildlife watch: keeping a protective eye on Carnac Island's sea lions

A camera mounted above a beach at Carnac Island is giving researchers real time footage of Australian sea lions and allowing them to monitor the endangered animals.

The equipment, which was installed in 2022, provides a window into the world of the male sea lions that use the A-class reserve to 'haul out' or recuperate between foraging and making return trips to their breeding islands.

The project involves researchers from the Department of Biodiversity, Conservation and Attractions, Edith Cowan University, and The Australian National University.

Associate Professor Chandra Salgado Kent from ECU, who is studying the mammals as part of the WAMSI Westport Marine Science Program, said the camera was providing valuable information.

"We are hoping to get an estimate of how many sea lions actually use the Perth metropolitan area and how many sea lions might use a particular haulout site like Carnac Island.," Associate Professor Salgado Kent said.

"The animals are not here year-round. They do migrate up to Jurien Bay for the breeding season which typically takes place every 17 to 18 months. Sea lions also spend a fair amount of time at sea foraging."

Australian sea lion numbers have struggled to recover since hunting was banned and while historically there may have been breeding in the Perth region, currently the area is only used by males.

> **"The camera there gives us a chance to keep an eye on the sea lions, see how many are there every day, if the numbers change throughout the day and what they may be doing."**

Associate Professor Salgado Kent said staff from the Department of Primary Industries and Regional Development had set up the camera and were managing and maintaining it which had been an enormous help for the project.

Project co-investigator Dr Sylvia Parsons, from DBCA, said researchers could change the direction the camera pointed and zoom in on particular animals. The researchers have marked nearly 50 sea lions with numbers using hair dye and have also fitted some with satellite trackers.

"We are hoping to be able to use the camera to identify some of the individuals that we have marked or tagged. We can then use this information to determine how long sea lions may spend on land between foraging trips and hopefully the data will help estimate the size of the population using this space," Dr Parsons said.

While the project is ongoing, she said the camera had helped them observe sea lions without disturbing them in any way.

"The camera provides a real-time window to be able to observe the behaviour and dynamics of the sea lions on the beach. The juveniles in particular seem to be the most active, coming out of the water and settling right next to other sea lions, which may result in the whole group reorganising themselves, before they relax and go back to their resting state again," Dr Parsons said.

The technology is also helping support other research including on fairy terns, which are another threatened species.

"It is one of the reasons that Carnac Island is closed every year during the breeding season," Associate Professor Salgado Kent said.

If nesting fairy terns are disturbed, they won't sit with their eggs which means the chicks won't hatch."
Researchers say the camera has also been valuable for DBCA management staff to detect if people are illegally going ashore and disturbing birds and sea lions.

"We want the community to be aware of the regulations and appropriate behaviour to ensure the conservation of these species," Dr Parsons said.

Huge numbers reached in survey of tiny fish larvae

The most comprehensive survey of fish larvae in Cockburn Sound has now uncovered more than 40,000 of the tiny creatures from at least 50 families. Researchers started monthly surveys in September 2021 as part of the WAMSI Westport Marine Science Program.

Researcher Jake Nilsen, from Curtin University, said at least 128 unique taxa had been identified, including pink snapper, whiting, trevallies and flatheads. Sea garfish and yellowfin whiting were recorded for the first time.

Another first-time recording was larvae of the highly sought after King George whiting. Mr Nilsen said this was a particularly interesting find given the species typically spawns further offshore. DNA techniques are also being used for species that are more challenging to identify and where there is limited information on their larval stages, including species of whiting and baitfish.

Now fieldwork has been completed, researchers will focus on analysing the vast dataset to identify patterns of when and where fish use Cockburn Sound during their larval stages. Researchers from the Department of Primary Industries and Regional Development are also working on the fish larvae project by providing research vessels and staff for the sampling.

Seagrass restoration project finding best sites for new meadows

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Murdoch University

Researchers who have transplanted seagrass shoots as part of a project to find the best locations within Cockburn Sound for seabed meadow restoration say, after five months, almost all of them are still alive.

The WAMSI Westport Marine Science Program project is looking at suitable habitats for seagrass restoration and involves teams from Murdoch University and The University of Western Australia.

Large areas of seagrass were wiped out in Cockburn Sound following industrial development and effluent discharge from the 1970s and in recent decades there have been dozens of projects to restore meadows.

Professor Jennifer Verduin, oceanographer and Pro Vice Chancellor at Murdoch University's College of Environmental and Life Sciences, said 92 percent of the transplanted seagrass shoots had so far survived.

As part of the project, shoots of *Posidonia australis* (one of the most widespread species of seagrass in the Sound) were collected from the edges of meadows near the Woodman Point channels. They were replanted at eight sites covering 60 square metres each.

"Three restoration plots per site were set up and in each plot the SCUBA divers planted 64 evenly spaced seagrass sprigs, which were anchored into the sand using steel pins"

Dr Giulia Ferretto from UWA's Oceans Institute said early results were promising but the team would have a better idea of how well-established the seagrass was in the restored sites after 12 months.

"The results from the one-year monitoring event will validate how plants survived during the first winter after transplantation and may be more indicative of long-term outcome," Dr Ferretto said.

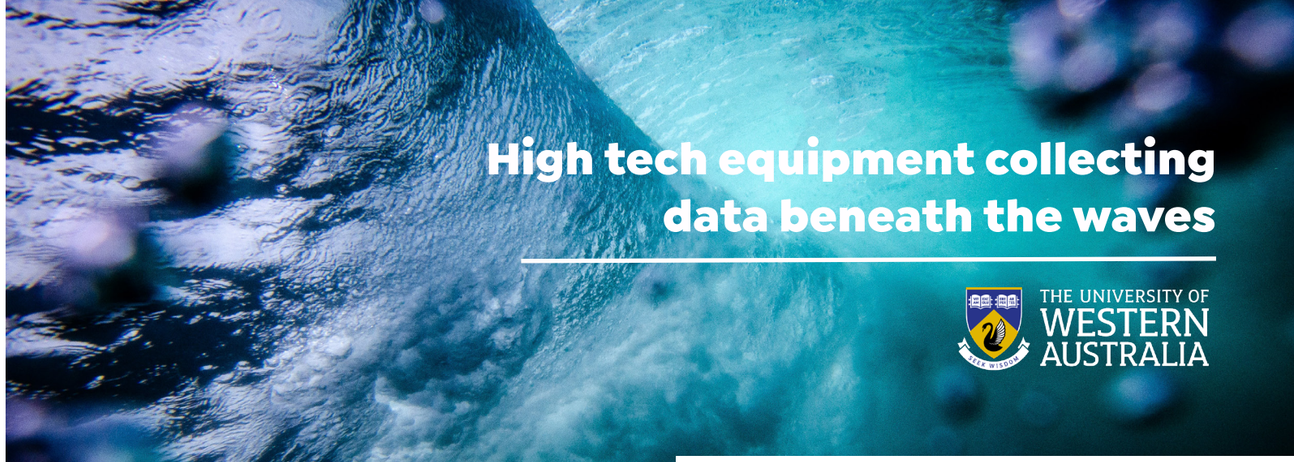
"That monitoring will take place in October and November."

The natural recovery of seagrasses has been slow since the 1980s and restoration efforts are considered essential.

"Seagrasses are a vital part of the ecosystem, for example they reduce coastal erosion by stabilising sediment, provide critical habitat for marine animals and efficiently store carbon," Dr Ferretto said.

Another WAMSI Westport Marine Science Program project which reviewed seagrass restoration programs over 30 years found that transplanted sprigs were most effective for rehabilitating larger areas.

"Monitoring a wide range of variables such as sediment quality, wave height and light, will contribute to evaluating the most suitable sites for seagrass growth," Dr Ferretto said.



High tech equipment collecting data beneath the waves

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Wave, current, sonar and camera equipment has been deployed underwater to allow researchers to track sediment flow in and around Cockburn Sound as part of a project which is expected to improve sand nourishment.

Research Fellow Dr Michael Cuttler, from The University of Western Australia's Oceans Institute, said the research team had set up the high-tech instrument suites during dive trips to three sites.

"At each site, we have the same instrument packages which are designed to measure sediment transport," Dr Cuttler said.

"They include acoustic instruments to measure waves and currents, and a three-dimensional scanning sonar and custom camera system to map and track seabed morphology.

"The instruments take measurements throughout the day and have already captured significant storm events this winter."

The equipment is mounted on frames that are attached to steel poles which are fixed to the sea floor.

Dr Cuttler said the systems work to track how and where the sediment moves.

"A lot of our coastal processes work is focused on understanding the beach dynamics – are they accreting or eroding and under what conditions," he said.

Dr Cuttler said one of the key knowledge gaps researchers had been trying to fill was sediment transport from the offshore source to the beach.

"Some of the applications for this work is understanding the potential beneficial reuse of dredge material," Dr Cuttler said.

"So, if they have excess material and want to use it for beach nourishment, where would be the best place to put it and then how long could we expect for that material to move onshore to act as sediment nourishment for the beach.

"One thought is that if you can understand the sediment transport pathways, you can optimise that nourishment, so it continually feeds the beach using natural processes."

The Coastal Processes project, led by UWA's Dr Jeff Hansen, is part of the WAMSI Westport Marine Science Program.

The equipment has been deployed three times since the start of the year during different seasons and a final deployment is planned for early 2024.

Dolphin surveys reviewed as part of science program

Murdoch University

A review of 145 boat-based surveys of bottlenose dolphins in Cockburn Sound and Owen Anchorage has offered important insights into the distribution of the marine mammals.

The review, which is part of the WAMSI Westport Marine Science Program, examined surveys conducted between 2011 and 2015 and covered a 180 square kilometre area.

Project leader Dr Delphine Chabanne, from Murdoch University, said the study aimed to achieve an overall understanding of the preferred habitat of the dolphins and where they were most likely to be in the Westport program area.

"The results of this study offer valuable insights into the distribution patterns of dolphins in the two areas, emphasising the importance of considering ecological complexities and potential impact of development."

Dr Chabanne said 213 dolphin groups were observed with most including calves.

While determining the specific environmental variables that explain the dolphin distribution has proven challenging, the information provided in this study can contribute to environmental impact assessments and guide management and conservation efforts aimed at ensuring the sustainable coexistence of dolphins in future development," Dr Chabanne said.

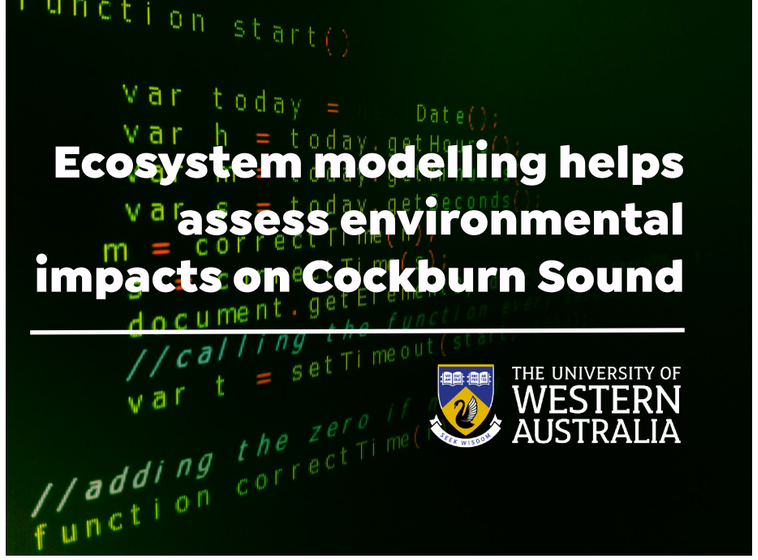
She said the most important areas for dolphins in Cockburn Sound were areas less than 10 metres deep.

"In Cockburn Sound, resident dolphins were seen across the entire region, but they were more frequently observed across the Kwinana Shelf, part of which is a designated area for port development. The Kwinana Shelf is recognised as an important nursing and]foraging habitat for dolphins, where large feeding aggregations involving dolphins and seabirds occur."

Dr Chabanne said while the broad-scale distribution patterns of the dolphins remained consistent over decades, the fine-scale distribution patterns within their respective residency regions may shift rapidly, within a few years.

"Therefore, a comprehensive understanding of the dolphins' distribution at both individual and ecosystem levels requires detailed investigation," she said.

The initial surveys were done as part of the Coastal and Estuarine Dolphin Project which was a collaborative research program between Murdoch University and Curtin University focused on the health, ecology and conservation of dolphins in the Perth region.



Ecosystem modelling helps assess environmental impacts on Cockburn Sound

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Time-lapse animations showing everything from Cockburn Sound's wave movements and temperature changes to nutrient hot spots are being created by a WAMSI Westport Marine Science Program research team as part of a project assessing the cumulative impacts of environmental stresses in the area.

Project leader Professor Matt Hipsey, from The University of Western Australia, said data from multiple sources had been used to create inter-linked models spanning oceanography, water quality and ecology.

"The goal is to build an integrated tool that can be used for cumulative impact assessment and help us understand all the stressors and drivers that have impacted the Sound in the past, and how it's likely to look into the future," Professor Hipsey said.

"Impacts may be caused by things like desalination and ground water discharges that enter the Sound, shipping and port operations, or from regional changes such as increased severity of marine heatwaves due to climate change.

"We have been looking at data on nutrient levels and water clarity to understand how that has changed over time, as this is an important driver for things like seagrass meadows which are ultimately important to determine the health of the system."

Professor Hipsey is collaborating on the project with researchers from Curtin University, other researchers from across the science program and industry consultants.

He said the Sound had changed over the past 70 years, and while conditions were no longer like the historical days of polluting discharges, there remained concerning legacy issues such as nutrients and other contaminants in the sediment.

"We have seen an evolution of all the things contributing to water quality and ecosystem health in the Sound, and while pollutant loads have been successfully regulated, one of the things we are still trying to understand is where the different nutrient sources are currently coming from," he said.

"There are large levels of nutrients in ground water that are still making their way in, even though they may have been discharged about 20 years ago. Also, one of the big concerns we have is a lot of nutrients from pollution that occurred in the 80s and 90s, are still slowly leaching out of the sediment."

Professor Hipsey said the further modelling could be used to assess the impact of any potential development.

"Our role within WAMSI is to build an independent, trusted, model that uses the best available tools and data. It is being developed as a public resource. Interested parties can use the platform to run specific scenarios relevant to Cockburn Sound's future," he said.

"We have a period of validation now where we are stress-testing and upgrading the model to reflect the latest knowledge coming from the WWMSP and making sure it is as accurate as it can be before it's used to assess scenarios or draw specific conclusions."

ACKNOWLEDGEMENT AND ARTICLE CONTRIBUTION

HOW DOES THE OCEAN'S ONLY FLOWERING PLANT COPE WITH BEING BURIED? (Page 1)
Pressure-response relationships, building resilience and future proofing seagrass meadows.
Project leaders: Kathryn McMahon (ECU) and Simone Strydom (DBCA)

WILDLIFE WATCH: KEEPING A PROTECTIVE EYE ON CARNAC ISLAND'S SEA LIONS (Page 3 & 4)
Australian sea lions.
Project leaders: Chandra Salgado Kent (ECU) and Kelly Waples (DBCA)

HUGE NUMBERS REACHED IN SURVEY OF TINY FISH LARVAE (Page 4)
Zooplankton in Cockburn Sound.
Project leaders: Joanna Strzelecki (CSIRO) and Jennifer McIlwain (CU)

SEAGRASS RESTORATION PROJECT FINDING BEST SITES FOR NEW MEADOWS (Page 5)
Snapper connectivity and evaluation of juvenile stocking.
Project Leader: Gary Kendrick (UWA) and Jennifer Verduin (MU)

HIGH TECH EQUIPMENT COLLECTING DATA BENEATH THE WAVES (Page 6)
Coastal processes in Cockburn Sound and Owen Anchorage: quantifying baselines and predicting Westport impacts.
Project leader: Jeff Hansen (UWA)

DOLPHIN SURVEYS REVIEWED AS PART OF SCIENCE PROGRAM (Page 7)
Spatio-temporal distribution of key habitat uses and key prey species for Indo-Pacific bottlenose dolphins in Owen Anchorage and Cockburn Sound, including a fine-scale understanding of the use of the habitats in the Kwinana Shelf.
Project Leader: Delphine Chabanne (MU)

ECOSYSTEM MODELLING HELPS ASSESS ENVIRONMENTAL IMPACTS ON COCKBURN SOUND (Page 8)
Pathways to productivity: Development of a water quality response model for Cockburn Sound.
Project leader: Matt Hipsey (UWA)

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